

REMARKS

Claims 24 - 71 are pending in this application. By this Amendment, claims 1 - 23 are canceled and claims 24 - 71 are new. The specification is also amended to include the Abstract. No new matter is added. Prompt and favorable consideration on the merits is respectfully requested.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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Attachment:

Abstract
Marked-up copy of Substitute Specification
Clean copy of Substitute Specification

Date: May 25, 2006

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New U.S. National Stage of PCT/EP2004/053097

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MARKED-UP COPY OF SUBSTITUTE SPECIFICATION

COMPOSITE ABRASIVE BODIES

[0001] This is a U.S. National Stage of Application No. PCT/EP2004/053097, filed November 25, 2004, which claims the benefit of European Patent Application No. 03027086.2, filed November 25, 2003. The disclosure of the prior applications is hereby incorporated by reference herein in their entirety.

[0002] Technical Field

[0003] ~~The invention~~ This disclosure relates to fabrication of composite abrasive bodies.

[0004] Prior Art

[0005] Abrasive products have been used for a long time for machining materials. Abrasive products consist of, *inter alia*, abradant granular particles ~~which~~ that are fixed to a backing material by means of a binder.

[0006] DE 198 53 550 C1 describes an abrasive flap disc in which abrasive grains are dispersed on a base bonding coat that is applied to a backing.

[0007] US 5,722,881 describes use of epoxies for bonding abrasive flaps to an abrasive wheel.

[0008] ~~A-Epoxy adhesives have the disadvantage of epoxies is the fact that they~~ either ~~they~~ have very long curing times or ~~else they~~ must be cured by heat. As a result, long holding times and/or high energy costs for curing are required for efficient mass production, which means increased costs for the production process.

DESCRIPTION OF THE INVENTION SUMMARY

[0009] Therefore, ~~an~~ the aim of the present ~~invention~~ disclosure is to provide composite abrasive bodies ~~which~~ that can be produced in such a way that avoids the disadvantages of the prior art ~~are avoided~~.

[0010] This disclosure provides novel composite abrasive bodies, as well as methods for their preparation and use. ~~It was surprisingly found that this can be accomplished by means of a composite abrasive body as specified by Claim 1, as well as a method for its fabrication as specified by Claim 18.~~

[0011] The novel composite abrasive bodies of embodiments may overcome the disadvantages of the prior art by the ~~This is achieved in particular by use of a two-component~~

polyurethane or (meth)acrylate adhesive ~~as specified by Claim 15 or Claim 16~~. Two-component polyurethane or (meth)acrylate adhesives cure extremely rapidly and in particular enable rapid bonding even at room temperature. This enables fast working times and energy-saving industrial mass production of these composite abrasive bodies.

[0012] These and other features and advantages of various embodiments of materials, devices, systems and/or methods are described in or are apparent from, the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Exemplary embodiments of the composite abrasive bodies and methods of preparing and using composite abrasive bodies ~~invention~~ are explained in more detail below with the help of the drawings. The same reference numbers are assigned to the same elements in the different figures. Force directions are indicated by arrows. These figures are intended to be illustrative and non-limiting; thus, only those elements essential for direct understanding of the disclosed composite abrasive bodies and methods for preparing and using composite abrasive bodies are shown.

~~— The drawings show:~~

~~— Fig. 1 — partial cross section through the abrasive product support/abrasive product/adhesive assembly;~~

[0014] Figures 1a-c) are partial schematic cross sectional views through an embodiment of an abrasive product support/abrasive product/adhesive assembly of this disclosure. In particular:

~~— in Fig. 1a), abrasive product bonded to abrasive product support along the longitudinal surface;~~

[0015] Figure 1a) is a partial cross sectional view showing an abrasive product bonded to an abrasive product support along a longitudinal surface,

~~— in Fig. 1b), abrasive product bonded to abrasive product support along its transverse edge;~~

[0016] Figure 1b) is a partial cross sectional view showing an abrasive product bonded to an abrasive product support along a transverse edge, and

~~— in Fig. 1c), a possible design for an abrasive product;~~

[0017] Figure 1c) is a partial cross sectional view showing a possible design for an embodiment of an abrasive product;

~~Fig. 2~~ view of an abrasive flap disc;

~~[0018]~~ Figure 2 is a schematic view of an abrasive flap disc of an embodiment of the disclosure.

~~Fig. 3~~ partial cross section through an abrasive flap disc along the line ~~AA~~;

~~[0019]~~ Figure 3 is a partial schematic cross sectional view of the abrasive flap disc shown in Figure 2, taken along the line AA.

~~Fig. 4~~ view of a grinding machine with abrasive flap disc;

~~[0020]~~ Figure 4 is a schematic view of a grinding machine with abrasive flap disc of an embodiment of the disclosure.

~~Fig. 5~~ view of an abrasive flap wheel;

~~[0021]~~ Figure 5 is a schematic view of an abrasive flap wheel of an embodiment of the disclosure.

~~Fig. 6~~ partial cross section through an abrasive flap wheel along the line ~~BB~~;

~~[0022]~~ Figure 6 is a partial schematic cross sectional view of the abrasive flap wheel shown in Fig. 5, taken along the line BB.

~~Fig. 7~~ view of a grinding machine with abrasive flap wheel;

~~[0023]~~ Figure 7 is a schematic view of a grinding machine with abrasive flap wheel of an embodiment of the disclosure.

~~Fig. 8~~ partial cross section through composite abrasive body to illustrate its fabrication;

~~[0024]~~ Figures 8a) and b) are partial schematic cross sectional views through a composite abrasive body to illustrate its fabrication. In particular:

~~in Fig. 8a), inserted abrasive products~~

~~[0025]~~ Figure 8a) is a partial schematic cross sectional view showing a composite abrasive body including inserted abrasive products, and

~~in Fig. 8b), after the abrasive products have been tilted~~

~~[0026]~~ Figure 8b) is a partial schematic cross sectional view showing a composite abrasive body in which the abrasive products have been tilted.

~~Only the elements essential for direct understanding of the invention are shown.~~

DETAILED DESCRIPTION OF EMBODIMENTS

EMBODIMENT OF THE INVENTION

_____ [0027] The present disclosure relates, in exemplary embodiments, to a composite abrasive body including at least one abrasive product support, at least one abrasive product, as well as at least one cured two-component polyurethane or (meth)acrylate adhesive bonding the abrasive product support and the abrasive product to each other. Abrasive particles ~~are~~ may also be present on the surface of the abrasive product.

_____ [0028] Herein, the term ~~Throughout this document, by~~ "(meth)acrylate" refers to ~~mean both~~ acrylic acid esters and methacrylic acid esters.

_____ [0029] The present ~~invention-disclosure~~ also relates, in exemplary embodiments, to the includes-use of a two-component (meth)acrylate adhesive in the fabrication of composite abrasive bodies. The two-component (meth)acrylate adhesive includes a , wherein the first component that contains at least one (meth)acrylate monomer and the a second component that contains at least one radical initiator. The two-component (meth)acrylate adhesive may be used to bond , in fabrication of a composite abrasive body, for bonding the abrasive product support and the abrasive product together.

_____ [0030] The present ~~invention-disclosure~~ also includes-relates, in exemplary embodiments, to the use of a two-component polyurethane adhesive in the fabrication of composite abrasive bodies. The two-component polyurethane adhesive includes a , wherein the first component that contains at least one polyamine or one polyol and the a second component that contains at least one polyisocyanate, in fabrication of a composite abrasive body. The two-component polyurethane adhesive may be used to bond , for bonding the abrasive product support and the abrasive product together.

_____ [0031] ~~Finally~~In addition, the present ~~invention includes a method~~ disclosure relates, in exemplary embodiments, to methods for fabrication of a fabricating composite abrasive body bodies. These methods include that includes the following operations: mixing of the two components of a two-component polyurethane or (meth)acrylate adhesive, ~~application-applying~~ of the mixed adhesive to the abrasive product support, bringing the mixed adhesive into contact with at least one abrasive product, and curing the adhesive.

_____ [0032] Figures 1 a-b) are partial schematic cross sectional views of schematically shows a composite abrasive body according to exemplary embodiments. The illustrated composite abrasive body comprisescomprising an abrasive product support 1 which-that is bonded to an abrasive product 2 by means of a two-component (meth)acrylate or

polyurethane adhesive 4. The abrasive product ~~here can~~may be bonded along the large-area surface (~~Fig. Figure~~ 1a) or at or around its transverse edge (~~Fig. Figure~~ 1b).

_____ [0033] Abrasive particles ~~3 are~~may be present on the surface of the abrasive product 2. Abrasive particles ~~3 are~~for use in embodiments may be made from materials such as are known to the person skilled in the art in this field. For example, ~~here the abrasive can~~particles may be prepared from natural or synthetic materials such as emery, garnet, flint, quartz, corundum, potassium fluoroborate, cryolite, chiolite, diamond, silicon carbide, cubic boron nitride (CBN), or the like. It is additionally known that these particles ~~can~~may be present in different grain sizes and grain shapes. The person skilled in the art ~~selects the~~may select suitable material or materials in the respectively suitable grain size or mix of grain sizes in the respectively optimal grain shape, depending on the specific grinding problem. The abrasive product of embodiments may ~~can~~ have these abrasive particles over the entire surface or only in certain areas. However, preferably in particular embodiments, the abrasive particles ~~3 are~~may be present only on one side of the abrasive product 2, such as in Figure 1c.

_____ [0034] A ~~In some embodiments, the abrasive product may be in the form of a flap-shaped abrasive member is especially preferred as abrasive product 2.~~

_____ [0035] The abrasive product, or the flap-shaped abrasive member, ~~can of~~embodiments may be ~~in turn be~~ designed in very different ways. ~~On the one hand, it~~In some embodiments, the abrasive product may ~~can~~ consist of a rigid material and abrasive particles 3, for example, as can be fabricated by a casting or sintering process from metal, ~~or~~ duromers or reactive resins, optionally by dispersing the abrasive particles on the rigid material or by rolling the abrasive particles into ~~it~~the rigid material.

_____ [0036] ~~On the other hand, they~~In other embodiments, the abrasive product may ~~can~~ be constructed from at least one cloth or paper 101, at least one binder 102, as well as abrasive particles 3, as shown schematically in Figure 1c. In such embodiments, the cloth may be a crossply ~~Crossply~~ or knit fabric ~~can also be used as the cloth~~. Fibers used for ~~this purpose the cloth in exemplary embodiments may~~ include carbon, glass, nylon, aramid, cotton, or polyester fibers as well as mixtures thereof.

_____ [0037] Various polymeric synthetic resins ~~are~~may be used as a binder 102 for embedding the abrasive particles in the cloth or paper material. For example, suitable binders include the, ~~in particular~~ reaction products based on polyepoxides, poly(meth)acrylates, or polyurethanes. ~~For example,~~ as well as binders based on phenol—formaldehyde resins or

polyimides are very suitable. Also suitable as binders for this purpose are the and two-component (meth)acrylate or polyurethane adhesives, such as those used to bind the abrasive product to the abrasive product support, and ~~4 or~~ the unfilled reactive components on which they ~~these two-component (meth)acrylate or polyurethane adhesives~~ are based.

_____ [0038] ~~Of course, in the case of~~ In embodiments in which the abrasive product includes a cloth, crossply, or knit fabric 101, the binder 102 can penetrate between the fibers, and may completely surround ~~and consequently the cloth, crossply, or knit fabric, and the binder may not be present can be surrounded completely by binder, and not only on only one side of the cloth, crossply or knit fabric,~~ as shown in Figure 1c. ~~It is also clear that the~~ The abrasive particles ~~can~~ may also be surrounded by cloth, crossply, or knit fabric 101 or their fibers, and not only by the binder 102.

_____ [0039] ~~It is especially preferred for~~ In certain embodiments, the abrasive particles ~~to~~ may be embedded in the binder, i.e., ~~for particles 3 to be partially surrounded by binder 102,~~ where part of the surface of the abrasive particles is free.

_____ [0040] In addition to the binder, optionally a size coat ~~can~~ may also be used in embodiments. Such a size coat ~~may be~~ which is applied over the binder 102 and, for example, ~~protects to protect~~ the binder from outside influences.

_____ [0041] ~~Abrasive~~ The abrasive product support 1 plays ~~may play~~ the role of a carrier for abrasive products in embodiments 2. The abrasive product support, in exemplary embodiments, may be ~~Usually the abrasive product support is connected to a machine, connected in particular such as by means of clamping forces, so that the abrasive product comes into contact with~~ contacts the material to be abraded by means of rotary or shearing motions, and thus the material removal operation is accomplished.

_____ [0042] The abrasive product support of exemplary embodiments may be ~~is made~~ either from a rigid material, such as metal or durometer plastics, or from an elastic material. Elastic materials may have the advantage that they can be easily adjusted to fit the contours of the workpieces to be abraded, and thus in particular they are suitable for fine grinding operations or for workpieces with complex surface geometries. A disadvantage of ~~However,~~ elastic abrasive product supports is ~~may have~~ the lower mechanical load bearing ~~capacity~~ capacities as well as the reduced ~~lifetime of the abrasive product support~~ lifetimes.

_____ [0043] Rigid materials may be used in some embodiments as abrasive product supports ~~do indeed and~~ have higher mechanical load bearing ~~capacity~~ capacities than elastic

materials. However, rigid materials, ~~but they~~ are difficult to use for grinding operations on workpieces ~~which that~~ have mostly non-planar surfaces.

_____ [0044] ~~Abrasive~~ The abrasive product support of exemplary embodiments may be ~~is preferably~~ a circular disc, a wheel, or a belt. ~~For this purpose, In some embodiments, the~~ abrasive product 2 ~~is preferably~~ may be bonded to the abrasive product support 1 on the largest area surface of the disc or wheel or belt, ~~in particular~~ such as in the radial direction of the disc or wheel.

_____ [0045] ~~Another advantageous option is for~~ In some embodiments, the abrasive product 2 ~~to may~~ be bonded to the abrasive product support 1 on the peripheral surface of the wheel or circular disc, ~~in particular~~ such as in a radial orientation.

_____ [0046] The adhesive used to bond the abrasive product support 1 and the abrasive product 2 ~~is in~~ embodiments may be a two-component polyurethane or (meth)acrylate adhesive. ~~Adhesive 4 reacts~~ The adhesive reacts very fast even at room temperature. However, the adhesive may also be ~~possibility that the adhesive can also be~~ cured at higher temperatures ~~is not ruled out~~. The adhesive ~~is may be~~ may be cured, in particular embodiments, at a temperature between 10°C and 180°C, ~~in particular~~ such as between 20°C and 80°C, ~~preferably between 20°C and 40°C, most preferably~~ or at room temperature. However, in particular for the two-component (meth)acrylate adhesive, it is advisable for safety reasons to use higher temperatures during application and curing.

_____ [0047] ~~If~~ In embodiments in which the adhesive is a two-component (meth)acrylate adhesive 4, ~~the adhesive, the~~ first component includes at least one (meth)acrylate monomer. Monofunctional, difunctional, trifunctional, tetrafunctional, and pentafunctional (meth)acrylate monomers are suitable. Particularly suitable (meth)acrylate monomers include methyl methacrylate, isobornyl (meth)acrylate, cyclohexyl (meth)acrylate, *t*-butyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, dicyclopentadienyl (meth)acrylate, dicyclopentadienyloxyethyl (meth)acrylate, ethylene glycol di(meth)acrylate, di-, tri-, tetraethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, di-, tri-, tetrapropylene glycol di(meth)acrylate, butanediol di(meth)acrylate, hexanediol di(meth)acrylate, epoxy (meth)acrylate (in particular as can be synthesized from (meth)acrylic acid and bisphenol-A diglycidyl ether, bisphenol-A diglycidyl ether oligomers, bisphenol-A or ethoxylated bisphenol-A), trimethylol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, dipentaerythritol penta(meth)acrylate, as well as mixtures of these monomers.

_____ [0048] The (meth)acrylate monomers ~~preferably have used in some embodiments~~ may have a glass transition temperatures above 55°C.

_____ [0049] Under certain circumstances and in certain embodiments, ~~it can be advantageous to select methyl methacrylate~~ may be selected as the (meth)acrylate monomer. For example, ~~this can be the case~~ methyl methacrylate may be used in embodiments in which if the intense odor of this monomer is not a problem. However, odorless monomers or monomers with only a slight odor ~~are preferred~~ may also be used in exemplary embodiments.

_____ [0050] The first component of the two-component (meth)acrylate adhesive of embodiments ~~preferably includes~~ may include at least one monomer selected from the group including isobornyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, diethylene glycol di(meth)acrylate, epoxy (meth)acrylate (in particular as can be synthesized from (meth)acrylic acid and bisphenol-A diglycidyl ether, bisphenol-A diglycidyl ether oligomers, bisphenol-A or ethoxylated bisphenol-A), trimethylol tri(meth)acrylate, as well as mixtures thereof.

_____ [0051] Methacrylates are particularly ~~preferred~~ useful as monomers of the first component of embodiments.

_____ [0052] ~~The~~ In embodiments, the second component of the two-component (meth)acrylate adhesive ~~includes~~ may include at least one radical initiator. All radical initiators known to the person skilled in the art in the field of (meth)acrylate adhesives are {suitable} as the radical initiator. Both thermal and photochemical radical initiators can be used. ~~Peroxides~~ In particular embodiments, ~~are preferred as the radical initiator is a peroxide,~~ including, in particular organic peroxides, ~~preferably~~ such as benzoyl peroxide.

_____ [0053] Two-component (meth)acrylate adhesives of the SikaFast® series (commercially available from Sika Schweiz AG ~~[Sika Switzerland]~~, Zürich) ~~or as are known from~~ and those disclosed in WO 02/070620 have been ~~[missing word?]~~ as particularly suitable, which is incorporated herein by reference in its entirety, may be particularly suitable for use in certain embodiments.

_____ [0054] ~~Just for the sake of completeness, here we mention that it is also possible in principle to use~~ In addition, a photochemically cured one-component (meth)acrylate adhesive may be used as the adhesive of embodiments, instead of a two-component (meth)acrylate adhesive. Photochemical curing is achieved by exposure to a light source, in particular a high-pressure mercury lamp or a laser. ~~A disadvantage of this solution, however~~ However, is the need for such such embodiments require a light source for curing, and this may be

~~undesirable for certain embodiments in which a light source and possibly the problem that for certain embodiments according to the present invention,~~ the adhesive area may be shaded.

_____ [0055] ~~If~~ In embodiments in which the adhesive is a two-component polyurethane adhesive, the first component of the adhesive ~~includes~~ may include at least one polyol or one polyamine and the second component ~~includes~~ may include at least one polyisocyanate.

_____ [0056] A polyamine is a molecule with two or more amine functional groups, such as in particular primary amine groups. Examples of ~~such polyamines are that may be suitable for use in embodiments are~~ aliphatic polyamines such as ethylenediamine, 1,2- and 1,3-propanediamine, 2-methyl-1,2-propanediamine, 2,2-dimethyl-1,3-propanediamine, 1,3- and 1,4-butanediamine, 1,3- and 1,5-pentanediamine, 1,6-hexanediamine, 2,2,4- and 2,4,4-trimethylhexamethylenediamine and mixtures thereof, 1,7-heptanediamine, 1,8-octanediamine, 4-Aminomethyl-1,8-octanediamine, 1,9-nonanediamine, 1,10-decanediamine, 1,11-undecanediamine, 1,12-dodecanediamine, methyl bis(3-aminopropyl)amine, 1,5-diamino-2-methylpentane (MPMD), 1,3-diaminopentane (DAMP), 2,5-dimethyl-1,6-hexamethylenediamine, cycloaliphatic polyamines such as 1,3- and 1,4-diaminocyclohexane, bis(4-aminocyclohexyl)methane, bis-(4-amino-3-methylcyclohexyl)methane, bis(4-amino-3-ethylcyclohexyl)methane, bis(4-amino-3,5-dimethylcyclohexyl)methane, 1-amino-3-aminomethyl-3,5,5-trimethylcyclohexane (= isophoronediamine or IPDA), 2- and 4-methyl-1,3-diaminocyclohexane and mixtures thereof, 1,3- and 1,4-bis(aminomethyl)cyclohexane, 1-cyclohexylamino-3-aminopropane, 2,5(2,6)-bis(aminomethyl)bicyclo[2.2.1]heptane (NBDA, manufactured by Mitsui Chemicals), 3(4),8(9)-bis(aminomethyl)tricyclo[5.2.1.0^{2,6}]decane, 3,9-bis(3-aminopropyl)-2,4,8,10-tetraoxaspiro[5.5]undecane, 1,3- and 1,4-xylylenediamine, ether group-containing aliphatic polyamines such as bis(2-aminoethyl) ether, 4,7-dioxadecane-1,10-diamine, 4,9-dioxadodecane-1,12-diamine and higher oligomers thereof, polyoxyalkylene polyamines with theoretically two or three amino groups, for example as can be obtained under the name Jeffamine[®] (manufactured by Huntsman Chemicals), aromatic amines such as, for example, 3,5-diethyl-2,4(2,6)-diaminotoluene (Lonzacure DETDA[®]), 3,5-dimethylthiotoluylenediamine (Ethacure 300[®]), 4,4'-methylene-bis(2,6-diethylaniline) (MDEA), 4,4'-methylene-bis(3-chloro-2,6-diethylaniline) (MCDEA), as well as mixtures of the aforementioned polyamines.

_____ [0057] A polyol is a molecule with two or more hydroxy functional groups. For example, the following commercially available polyols or any mixtures thereof can be used in exemplary embodiments:

_____ [0058] ~~Polyoxyalkylene polyoxyalkylene~~ polyols, also called polyether polyols, which are the polymerization product of ethylene oxide, 1,2-propylene oxide, 1,2- or 2,3-butylene oxide, tetrahydrofuran or mixtures thereof, optionally polymerized using an initiator molecule with two or three active H atoms such as, for example, water or compounds with two or three OH groups and/or NH₂ groups. Polyoxyalkylene polyols ~~can be used that have~~ that may be used include those having a low degree of unsaturation (measured according to ASTM D-2849-69 and expressed in milliequivalents of unsaturation per gram polyol (meq/g)), synthesized for example using "double metal cyanide complex catalysts" (DMC catalysts for short), as well as polyoxyalkylene polyols with a higher degree of unsaturation, synthesized for example using anionic catalysts such as NaOH, KOH, or alkali metal alkoxides. Polyoxyalkylene diols and triols ~~are especially~~ that may be particularly suitable for use in embodiments are those that ~~which~~ have a degree of unsaturation below 0.02 meq/g and a molecular weight in the range from 1000 to 30 000 g/mol, polyoxypropylene diols and triols with a molecular weight from 400 to 8000 g/mol, as well as "EO-endcapped" (ethylene oxide-endcapped) polyoxypropylene diols or triols. The latter are special polyoxypropylene polyoxyethylene polyols, that can be obtained, for example, by alkoxyating pure polyoxypropylene polyols with ethylene oxide, after completion of polypropoxylation, and thus have primary hydroxyl groups. ~~Here and in the following, by~~ Herein, the term "molecular weight" ~~we always mean~~ refers to the average molecular weight M_w .

_____ [0059] ~~Polyhydroxy polyhydroxy~~-terminated polybutadiene polyols;

_____ [0060] ~~Polyester polyester~~ polyols, synthesized for example from dihydric or trihydric alcohols such as, for example, 1,2-ethanediol, diethylene glycol, 1,2-propanediol, dipropylene glycol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, neopentyl glycol, glycerol, 1,1,1-trimethylolpropane or mixtures of the aforementioned alcohols, with organic dicarboxylic acids or their anhydrides or esters such as, for example, succinic acid, glutaric acid, adipic acid, suberic acid, sebacic acid, dodecanedicarboxylic acid, maleic acid, fumaric acid, phthalic acid, isophthalic acid, terephthalic acid, and hexahydrophthalic acid or mixtures of the aforementioned acids, as well as polyester polyols derived from lactones such as, for example, ϵ -caprolactone;

_____ [0061] ~~Polyether polyether~~ polyols or polyester polyols synthesized from tetrahydric or polyhydric alcohols such as pentaerythritol, sorbitol, mannitol, and other sugar-based alcohols.

_____ [0062] ~~Polycarbonate polycarbonate~~ polyols, as can be obtained, for example, by reaction of the above-indicated alcohols (used to synthesize the polyester polyols) with dialkyl carbonates, diaryl carbonates, or phosgene.

_____ [0063] ~~The~~ In embodiments, the above-indicated polyols may have an average molecular weight from 250 to 30 000 g/mol and an average number of OH functional groups in the range from 1.6 to 3.

_____ [0064] In addition to the above-indicated polyols, the following can be used as the first component of embodiments: low molecular weight compounds with two or more hydroxyl groups such as, for example, 1,2-ethanediol, 1,2- and 1,3-propanediol, neopentyl glycol, diethylene glycol, triethylene glycol, the isomeric dipropylene glycols and tripropylene glycols, the isomeric butanediols, pentanediols, hexanediols, heptanediols, octanediols, nonanediols, decanediols, and undecanediols, 1,3- and 1,4-cyclohexanedimethanol, hydrogenated bisphenol A, 1,1,1-trimethylolethane, 1,1,1-trimethylolpropane, glycerol and sugar alcohols and other alcohols with a high number of OH groups.

_____ [0065] A polyisocyanate is a molecule with two or more isocyanate groups. ~~This in particular means~~ In embodiments, the second component of the adhesive may be a polyurethane prepolymer ~~which that~~ can be synthesized from polyisocyanates, in particular selected from the group including 1,6-hexamethylene diisocyanate (HDI), 2,4- and 2,6-toluylene diisocyanate (TDI), 4,4'-diphenylmethane diisocyanate (MDI), 1-isocyanato-3,3,5-trimethyl-5-isocyanatomethylcyclohexane (= isophorone diisocyanate or IPDI), their isomers, their polymers, as well as their mixtures, and polyols, ~~in particular including those the polyols already mentioned set forth above, in particular such as~~ polyoxyalkylene polyols.

_____ [0066] Two-component polyurethane adhesives of the SikaForce® series (commercially available from Sika Schweiz AG [~~Sika Switzerland~~], Zürich) ~~have been~~ [missing word?] may be especially suitable for this purpose use in embodiments.

_____ [0067] The early strength (at least until achievement of early strength high enough to permit transport of the composite abrasive body) of a two-component polyurethane or (meth)acrylate adhesive at room temperature ~~is preferably~~ may be achieved, in some embodiments, within less than 30 minutes, ~~in particular such as~~ within less than 10 minutes,

as measured from the time the two components are mixed. In ~~special cases~~specific embodiments, an early strength achieved within less than 5 minutes ~~may even be desired~~may be achieved.

_____[0068] Two-component polyurethane or (meth)acrylate adhesives of embodiments additionally may provide potlives at room temperature of ~~preferably~~ less than 20 minutes, ~~in particular~~in particular embodiments, of less than 10 minutes. In ~~special cases~~specific embodiments, a potlife of less than 5 minutes ~~is advantageous~~may be obtained.

_____[0069] Two-component (meth)acrylate adhesives are ~~the preferred~~used as the adhesives of certain embodiments, ~~since because~~ this type of adhesive provides extremely favorable curing behavior. As a result of the radical polymerization mechanism, the viscosity of the adhesive abruptly increases considerably only at the very end of the open time, so the adhesive can be easily worked to practically the same extent throughout the time between mixing and this rise in viscosity at the end of the open time. This is not the case for addition polymerization, as occurs for two-component polyurethane adhesives, which may be used in other embodiments. In ~~that case~~embodiments in which the adhesive is a two-component polyurethane adhesive, the viscosity rises steadily after mixing, so the handling properties change considerably even before the end of the potlife. (Meth)acrylate adhesives are likewise advantageously used in some embodiments, because they reach final strength faster.

_____[0070] It ~~has proven to be especially advantageous if the~~ In embodiments, the two-component (meth)acrylate or polyurethane adhesive displays ~~may display~~ thixotropic behavior. Such thixotropic properties can be induced chemically or physically. In embodiments, the adhesive may ~~It can also be advantageous for the adhesive to have a~~ pasty consistency. Thixotropy or a pasty consistency is especially advantageous for some embodiments because the effect is that an abrasive product inserted into the adhesive is held in this position at least long enough for the adhesive to become sufficiently crosslinked ~~so that the adhesive~~ has enough strength to hold the abrasive product in position. Thixotropy is especially ~~preferred~~useful in certain embodiments, ~~since because~~ the thixotropic behavior allows the abrasive product to be easily inserted into the adhesive ~~but then it is~~and held in position, without its own weight making it ~~the abrasive product~~ tip over in an uncontrolled manner.

_____[0071] A two-component (meth)acrylate or polyurethane adhesive can also, as needed in ~~each case~~embodiments, contain other components such as fillers, drying agents,

catalysts, thixotropic agents, additives such as adhesion promoters, light stabilizers, defoamers, flow-control agents, and impact strength modifiers. Persons skilled in the art will use their expertise in using such additives, and will use them respectively in one or both components.

_____[0072] Figure 2 depicts an abrasive flap disc 9, which represents a ~~preferred one~~ embodiment of a composite abrasive body. Here, the abrasive products 2 are flap-shaped abrasive members that are disposed on abrasive product support 1, partially overlapping each other in a fan-like manner, and are bonded to abrasive product support 1 by means of a two-component (meth)acrylate or polyurethane adhesive.

_____[0073] This structure also can be described as a shingle-like arrangement of abrasive flaps. Abrasive product support 1 here has the shape of a circular disc. The disc ~~preferably has~~may have a hole 5 in the center, through which a mandrel 7 ~~can~~may be inserted. Abrasive product support 1 also ~~preferably has~~may have a reinforcing ring 6.

_____[0074] Figure 3 depicts a partial cross section along line AA of Figure 2, through the peripheral area of abrasive flap disc 9 and shows abrasive products 2, partially overlapping in a shingle-like fashion, with abrasive particles 3 on their surfaces. The abrasive products are joined to abrasive product support 1 with polyurethane or (meth)acrylate adhesive 4.

_____[0075] ~~Finally,~~ Figure 4 depicts a view of a grinding machine 8 with abrasive flap disc 9 connected by means of mandrel 7, which ~~{missing word?}~~is inserted through hole 5. The abrasive flap disc has abrasive products 2 radially bonded to disc-shaped abrasive product support 1.^{i}

_____[0076] Figure 5 depicts an abrasive flap wheel 12, which represents another ~~preferred~~ embodiment of a composite abrasive body. Here, the abrasive products 2 are flap-shaped abrasive members disposed on abrasive product support 1, partially overlapping each other, and are bonded to abrasive product support 1 by means of a two-component (meth)acrylate or polyurethane adhesive 4. Abrasive products 2 ~~here-in this embodiment~~ are on the peripheral surface of the abrasive flap wheel. The abrasive flap wheel ~~preferably has~~may have a hole at the centerline point and optionally a nut 10 with thread 11 on the inside of the nut. The abrasive flap wheel also ~~preferably has~~may have a reinforcing ring 6.

_____[0077] Figure 6 depicts a partial cross section along line BB of Figure 5, through the peripheral area of abrasive flap wheel 12 and shows abrasive products 2, partially overlapping

in a shingle-like fashion, with abrasive particles 3 on their surfaces. The abrasive products are joined to abrasive product support 1 with a polyurethane or (meth)acrylate adhesive 4.

_____ [0078] Finally, Figure 7 depicts a schematic view of a grinder 13 ⁱⁱ with an abrasive flap wheel 12 ~~[possibly missing words]~~ ⁱⁱⁱ 12.

_____ [0079] Another ~~preferred~~ embodiment of a composite abrasive body is an arrangement in which the abrasive product support 1 is a wheel and abrasive products 2, ~~in particular~~ such as flap-shaped abrasive products that stick and sticking out radially on the peripheral surface of the wheel in the vertical direction relative to the peripheral surface, are bonded with a two-component polyurethane or (meth)acrylate adhesive 4.

_____ [0080] Another ~~preferred~~ embodiment of a composite abrasive body is an abrasive belt. Here, the abrasive product 2 is bonded flat against an abrasive product support 1 ~~product 2~~ using two-component polyurethane or (meth)acrylate adhesive 4. The abrasive belt can be a sheet or an endless belt.

_____ [0081] The present ~~invention~~ disclosure also includes ~~a method~~ embodiments directed to methods for fabrication of a composite abrasive body.

_____ [0082] ~~This method~~ The method of embodiments includes at least the steps described below. The two components of a two-component polyurethane or (meth)acrylate adhesive 4 ~~are~~ adhesive are mixed with each other. This operation ~~is~~ may be carried out with conventional mixing devices, ~~in particular~~ such as by means of a static mixer. Then, the mixed adhesive ~~is~~ may be applied to the abrasive product support, ~~preferably~~ such as in the form of an adhesive bead. This operation ~~is~~ may be done where the abrasive products are to be joined to the abrasive product support, ~~in particular~~ for example in the peripheral areas of a disc or a wheel. Then, the mixed adhesive ~~is~~ may be brought into contact with at least one abrasive product before the potlife of the adhesive has elapsed.

_____ [0083] This contact should, in embodiments, ~~preferably~~ be made in such a way that the abrasive product, which ~~is preferably~~ may be a flap-shaped abrasive member, ~~is~~ may be inserted into the mixed uncured adhesive, which is ~~(applied to the~~ abrasive product support, 1) essentially vertically with respect to the abrasive product support surface, so that part of the surface is covered by adhesive. Such an arrangement is depicted schematically in ~~Fig.~~ Figure 8a). Finally, the adhesive is cured.

_____ [0084] One more step, involving tilting the abrasive products, ~~preferably occurs~~ may be performed between bringing the abrasive products into contact with the mixed adhesive

and curing of the adhesive. In ~~this way~~ such embodiments, the abrasive products, inserted next to each other in the uncured adhesive, ~~are may be~~ taken from an essentially vertical orientation to a tilted orientation in a controlled manner. Thus a fan-like or shingle-like partial overlapping of the abrasive products 2 is achieved, as shown schematically in Figure 8. This is achieved, in particular embodiments, by means of a tangential force ~~preferably that may be~~ exerted on the abrasive products on the side opposite the adhesive, as is shown schematically in Figure 8a.

_____ [0085] The abrasive products ~~are advantageously~~ of some embodiments may be tilted only after all the abrasive products have been brought into contact with the adhesive.

_____ [0086] In the case of fabrication of an abrasive flap disc 9, this tilting of the flap-shaped abrasive members ~~is preferably~~ may be achieved by means of a combination rotational and pushing motion of a body touching the free edge of the upright flap-shaped abrasive members.

_____ [0087] ~~It also can~~ In some embodiments, it may be advantageous for the surface of the abrasive product support 1 and/or the abrasive product 2 to undergo chemical or physical pretreatment before bonding. Such pretreatment ~~involves~~ may involve, for example, grinding, brushing, sand blasting, treatment with cleaning agents, adhesion promoter solutions, or primers. ~~This can,~~ Such treatments may, for example, result in better adhesion and thus lead to greater safety and/or load bearing capacity of the abrasive composite.

_____ [0088] The steps of mixing, ~~application~~ applying, bringing into contact, and curing the adhesive may be typically ~~are~~ carried out at a temperature between 10°C and 180°C, ~~usually such as~~ between 20°C and 80°C, in particular or between 20°C and 40°C. This ~~These steps may also be performed~~ is preferably done at room temperature.

_____ [0089] ~~This described~~ The above-described method is then may be especially ~~to be employed useful~~ if the adhesive ~~4 used~~ adhesive used exhibits thixotropic behavior and/or has a pasty consistency.

_____ List of reference numbers

_____ 1 _____ Abrasive product support

_____ 2 _____ Abrasive products

_____ 3 _____ Abrasive particles

_____ 4 _____ Polyurethane or (meth)acrylate adhesive

_____ 101 _____ Cloth or paper

- 102 — Binder
 - 5 — Hole
 - 6 — Reinforeing ring
 - 7 — Mandrel
 - 8 — Grinding machine
 - 9 — Abrasive flap disc
 - 10 — Nut
 - 11 — Thread
 - 12 — Abrasive flap wheel
 - 13 — Grinder
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